star brightened uniformly across the spectrum, just as you would expect from gravitation lensing. Flaring stars, in contrast, generally get hotter and therefore should brighten more at shorter wavelengths.

The real test, say both Alcock and Spiro, will come when they've collected a sample of 10 to 20 events. If the brightening results from some new type of stellar explosion, it should tend to take place in a single type of star. If it's really lensing by MACHOs, the distribution of stellar types should be random.

If the putative MACHOs survive these tests, the next question will be how prevalent they are, and how much of our galaxy's dark mass they can account for, says Christopher Stubbs of the Livermore team. But even if MACHOs can explain all our galaxy's missing mass, notes Ostriker, they may not solve the full riddle of dark matter.

Many theorists believe that in addition to the extra mass needed to explain how stars move within galaxies, the universe contains still more dark matter between galaxies—so much extra, in fact, that its gravitational pull will slow and eventually stop the expansion of the universe. If so, as much as 99% of the universe may be invisible. Astrophysicists believe that the Big Bang simply can't have produced that much ordinary matter—which means that the additional dark matter would have to be made of something far more exotic than MACHOs. In that case, our galaxy's silent majority would be just a minority in a larger dark universe.

–Faye Flam

MATERIALS SCIENCE

High-T_c Superconductors Get Squeezed

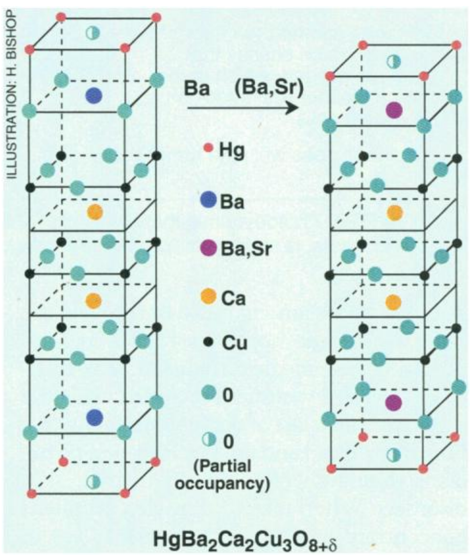
Squeeze most things hard enough and they'll say "uncle." Ceramic superconductors are no exception. In last week's *Nature* and this week's *Science*, two laboratories independently report that mercury-containing ceramic superconductors, when squeezed unimaginably tightly between the jaws of diamond or tungsten carbide vises, yield to researchers' wishes and become superconducting at 150 degrees Kelvin—surpassing previous records by 15 degrees.

Because of the enormous pressures required, this result has no immediate practical value. Yet this result still "has very good psychological value," says Robert Cava of AT&T Bell Laboratories, a veteran of the search for new high-temperature superconductors. Adds Cava, "It gives some hope that the transition temperature can still go higher." By redesigning their compounds to have structures that mimic the mercury-containing compounds under pressure, investigators hope to achieve the same results—or still better ones—under normal conditions. That would inch the field toward one of its ultimate goals, a material that is superconducting at 300 K, room temperature.

From 1988 through last March, a thallium-containing copper oxide compound was at the top of the superconductor charts, with a transition temperature of 127 K. That material reigned so long that it was beginning to dim hopes of finding superconductors with still higher transition temperatures. The gloom lifted in March, when a Russian and French team, including two authors of this week's report in *Science*, reported in *Nature* that a new compound composed of mercury, barium, copper, and oxygen atoms becomes a superconductor at 94 K. That was lower than the thallium material, but the newcomer was just the first and simplest of a new mercury-containing superconductor family of unknown potential.

The new family grouping really began to show its mettle in May, when researchers at the Eidgenössische Technische Hochschule (ETH) in Zurich reported in *Nature* that a crystalline mix of mercury-containing compounds remained superconducting at 133 K—finally breaking the 127 K barrier (*Science*, 7 May, p. 755). Testing the mercury compounds at high pressures was the obvious next step, because researchers have known since the earliest days of high-temperature superconductivity that pressure affects the temperatures at which materials become superconducting.

Last week, physicist C.W. (Paul) Chu of the Texas Center for Superconductivity at the University of Houston and colleagues reported the results in *Nature*. They found that under pressures of about 150,000 atmospheres, one of the mercury compounds, called Hg-1223, which has mercury, barium, calcium, and copper atoms in a ratio of 1:2:2:3, started to make its transition to a superconducting state at 153 K. The material's resistance actually fell to near zero only when chilled to 135 K. Higher pressures would likely have raised that figure, say the researchers, but the tungsten-carbide vise they used could not squeeze any harder without breaking.



The big squeeze. Strontium in place of barium ions might mimic the effects of high pressure in this superconducting ceramic.

On page 97, physicist Manuel Nuñez-Regueiro of the Center for Research at Extremely Low Temperatures at France's National Center for Scientific Research (CNRS) in Grenoble and his colleagues confirm Chu's prediction that the higher pressures might produce even more impressive results. They show that their Hg-1223 samples, if squeezed to 235,000 atmospheres (the maximum pressure possible with their sintered diamond anvil vise), begin the transformation to a superconductor at 157 K and just about finish at 150 K.

Neither group can say why the high pressure boosts the transition temperature, because the samples cannot be salvaged for study when the pressure is released. They assume, however, that the pressure reduces the distance between adjacent layers of the crystal, a change that often increases the transition temperature of a ceramic superconductor. By substituting "chemical pressure" for mechanical pressure, the researchers hope to create a compound that would boast the same properties under normal conditions. Replacing the compound's relatively large barium ions with smaller ones such as strontium, they say, should pull the layers together, mimicking the effect of squeezing.

"It would be truly exciting" if a transition temperature of 150 K could be achieved outside a high-pressure cell, adds Venky Venkatesan of the University of Maryland. A material with a transition temperature nearly twice the temperature of its liquid nitrogen coolant, he says, would offer a welcome safety margin for cooling failures or fluctuations in both scientific measurements and applications. And Chu notes that such compounds could be chilled with coolants even cheaper than liquid nitrogen, among them the environmentally notorious Freon. On the negative side, as Cava points out, the mercury compounds are hard to make because mercuric oxide, one ingredient, normally decomposes at temperatures hundreds of degrees below those needed to form the ceramic. In the search for better superconductors, it seems, the pressure is still on.

–Ivan Amato